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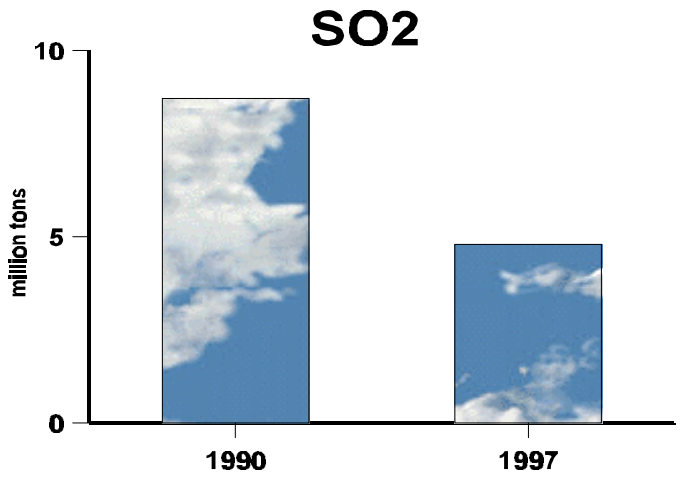
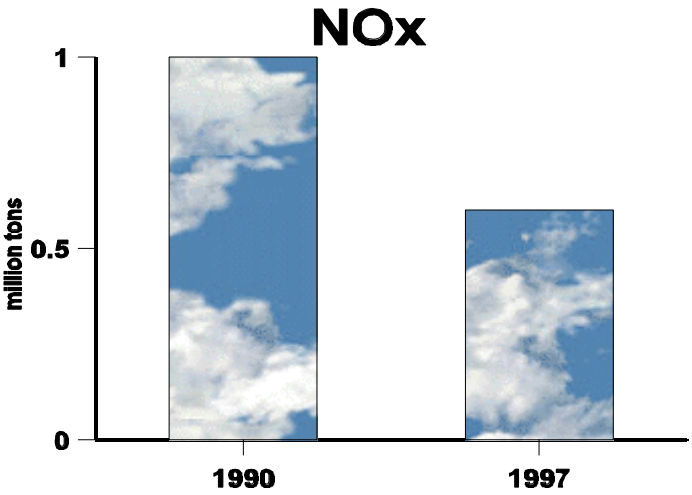
1997 Compliance Report

Acid Rain Program





ACID RAIN PROGRAM

BACKGROUND

The Acid Rain Program was established under Title IV of the 1990 Clean Air Act Amendments. The program calls for major reductions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), the pollutants that cause acid rain, while establishing a new approach to environmental protection through the use of market incentives. The program sets a permanent cap on the total amount of SO_2 that may be emitted by electric utilities nationwide at about one half of the amount emitted in 1980, and allows flexibility for individual utility units to select their own methods of compliance. The program also sets NO_x emission limitations (in lb/mmBtu) for electric utilities, representing about a 27 percent reduction from 1990 levels. The Acid Rain Program is being implemented in two phases: Phase I began in 1995 for SO_2 and 1996 for NO_x, and will last until 1999; Phase II for both pollutants begins in 2000 and is expected to involve over 2,000 units. In 1997, there were 423 units affected by the SO_2 provisions of the Acid Rain Program, 187 of which were also affected for NO_x, and an additional 351 utility units affected only by the NO_x provisions.

Acid rain causes acidification of lakes and streams and contributes to the damage of trees at high elevations. In addition, acid rain accelerates the decay of building materials, paints, and cultural artifacts, including irreplaceable buildings, statues, and sculptures. While airborne, SO_2 and NO_x gases and their particulate matter derivatives, sulfates and nitrates, contribute to visibility degradation and impact public health.

The SO_2 component of the Acid Rain Program represents a dramatic departure from traditional command and control regulatory methods that establish source-specific emissions limitations. Instead, the program introduces a trading system for SO_2 that facilitates lowest-cost emissions reductions and an overall emissions cap that ensures the maintenance of the environmental goal. The program features tradable SO_2 emissions allowances, where one allowance is a limited authorization to emit one ton of SO_2. Allowances may be bought, sold, or banked by utilities, brokers, or anyone else interested in holding them. Existing utility units were allocated allowances for each future compliance year and all participants of the program are obliged to surrender to EPA the number of allowances that correspond to their annual emissions starting either in Phase I or Phase II of the program.

The NO_x component of the Acid Rain Program is more traditional, and establishes an emission rate limit for all affected utilities. Flexibility is introduced to this command and control measure, however, through compliance options such as emissions averaging, whereby a utility can meet the standard emission limitations by averaging the emissions rates of two or more boilers. This allows utilities to over-control at units where it is technically easier to control emissions, thereby achieving emissions reductions at a lower cost. Additionally, beginning in 1997, certain Phase II units could elect to become affected for NO_x early. By complying with Phase I limits, these early election units can delay meeting the more stringent Phase II limits until 2008.

At the end of each year, utilities must demonstrate compliance with the provisions of the Acid Rain Program. For the NO_x portion of the program, utilities must achieve an annual emission limitation at or below mandated levels. For SO_2, utilities are granted a 30-day grace period during which additional SO_2 allowances may be purchased, if necessary, to cover each unit's emissions for the year. At the end of the grace period (the Allowance Transfer Deadline), the allowances a unit holds in its Allowance Tracking System (ATS) account must equal or exceed the unit's annual SO_2 emissions. In addition, in 1995-1999 (Phase I of the program), units must have sufficient allowances to cover certain other deductions as well. Any remaining SO_2 allowances may be sold or banked for use in future years.

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TO THE READER:

The 1997 Compliance Report once again announces 100 percent compliance with the Acid Rain Program, now in its third year of sulfur dioxide (SO_2) compliance and its second year of nitrogen oxides (NO_X) compliance. Affected facilities continued to exceed the targets set for both pollutants by the Clean Air Act Amendments of 1990. The early reductions seen in 1995 and 1996 for SO_2 continue, with affected utility units beating their 1997 target by 23 percent. The overcompliance with the NO_X target also continues, achieving an average emission rate for Phase I units 16 percent below the compliance rate.

Trading activity in the SO_2 arena continues to rise dramatically; the number of private trades between economically distinct organizations in 1997 is greater than the number of corresponding trades in all previous years combined. This increasingly active market, coupled with the success of the industry in exceeding compliance goals, has encouraged EPA to continue in its efforts to support other programs seeking to implement trading in order to achieve environmental goals at lower costs.

The Acid Rain Program is continually striving to find new ways to improve the efficiency with which it carries out its mission. For example, despite the addition of compliance determinations for 272 new Phase II early election units and supplemental determinations of compliance with Phase I extension provisions for 1997, EPA was able to complete the annual reconciliation process in the same amount of time as it did for 1996. This faster completion time was facilitated by fewer errors in submission of emissions data by the sources, which reduced the need for subsequent resubmissions; the improved quality of these data reports were in turn facilitated by the improvements to the Emissions Tracking System made by EPA which allowed faster feedback to be provided to sources each quarter.

I would like to thank those in the industry for their efforts to work in partnership with EPA. We expect to continue our efforts by making improvements in our rules and procedures, as well as upgrading the Emissions and Allowance Tracking Systems. Together, we can improve the efficiency of the Acid Rain Program and realize its significant environmental benefits.

Brian J. McLean, Director
Acid Rain Program

SUMMARY

100 Percent Compliance for both SO_2 and NO_x in 1997

All 774 boilers and combustion turbines (referred to as "units") affected by the SO_2 and NO_x regulations of the Acid Rain Program in 1997 successfully met their emissions compliance obligations.[1]

All 423 units subject to SO_2 requirements in 1997 held sufficient allowances to cover their emissions. The 5,480,210 allowances deducted from compliance accounts represent approximately 77 percent of all 1997 allowances issued and 41 percent of all 1995, 1996, and 1997 allowances that were available for compliance. Almost all of the deducted allowances (5,474,440, or 99.9 percent) were for emissions, but other deductions were also made as required by the Acid Rain regulations.

All 537 units subject to the NO_x requirements in 1997 demonstrated compliance with applicable annual emission limitations. Of these 537 units, 239 were also subject to SO_2 requirements, while 298 units were affected only for NO_x (26 Phase I units and 272 Phase II "early election" units).

1997 SO_2 Emissions of Phase I Units were 23 Percent Below Allowable Level

SO_2 emissions in 1997 were 1.7 million tons (or 23 percent) below the 7.1 million ton allowable level as determined by 1997 allowance allocations. Since an additional 6.3 million allowances were carried over, or banked, from 1996, the overall number of allowances available in 1997 was 13.4 million, of which affected units exhausted only about 41 percent. Actual emissions for the 423 units participating in 1997, measured by continuous emission monitoring systems (CEMS), were 5.5 million tons, up less than 100,000 tons from emissions of the 431 units affected in 1996.

1997 Phase I Unit NO_x Emission Rates 41 Percent Below 1990; NO_x Tons 32 Percent Lower Than in 1990

Emission rates for the 265 Phase I utility units dropped by 41 percent below 1990 levels; from an average of 0.69 pounds of NO_x per million Btu of heat input (lb/mmBtu) to an average of 0.40 lbs/mmBtu, 17 percent below the compliance rate of 0.48 lbs/mmBtu for these units. Emission levels for these units were 409,322 tons (or 32 percent) below 1990 levels.

1997 NO_X Emission Rates of Early Election Units Even Lower Than Phase I Units'

[1]Four units have been "conditionally" deemed to be in compliance with their NO_x requirements, two early election units and two Table 1 units. The two Table 1 units are awaiting a final determination on their AEL demonstration period petition, the two early election units are awaiting a change in their permit conditions.

For the 272 Phase II units which elected to meet Phase I NO_x rates early, emission rates dropped from an average of 0.46 lbs/mmBtu in 1990 to 0.38 lbs/mmBtu in 1997, a 17 percent decrease and 19 percent below the compliance rate of 0.47 lbs/mmBtu for these units. Therefore, while utilization of these units increased by 24 percent between 1990 and 1997, NO_x tons increased by only 2 percent.

Monitoring Performance Excellent Once Again

For the third year of the Acid Rain Program, the continuous emission monitors used by participants continue to provide some of the most accurate and complete data ever collected by the EPA. Statistics reflect excellent monitor operation of all utility units affected by both Phase I and Phase II of the program.

Accuracy:	98.4 percent of the installed and tested monitors met the required relative accuracy standards on the first attempt, while less than two percent needed appropriate monitor adjustments to meet the standards; SO_2 monitors achieved a median relative accuracy (i.e., deviation from the reference test method) of 3.2 percent; flow monitors, 3.5 percent; and NO_x monitors, 3.3 percent.
Reliability:	SO_2 and flow monitors achieved a median reliability of 99.3 and 99.5 percent, respectively, while NO_x monitors achieved a median reliability of 98.8 percent.

SO_2 Market Active; Volume of Allowances Transferred Between Distinct Entities in 1997 Exceeds the Total of 1994, 1995, and 1996 Combined

Activity in the allowance market continued to increase in 1997. The volume of allowances transferred between unrelated parties in economically significant trades increased from 4.4 million in 1996 to 7.9 million in 1997. More than 80 percent of Phase I and Phase II affected utility companies have already engaged in at least one private transfer registered in ATS.

Following the all-time low cost of allowances of $68 at the 1996 allowance auction, prices increased to $110 in the 1997 auction. Later in 1997, prices dipped again to a low of $88, to finish in 1997 at about $100. Prices have increased again in the first half of 1998, with the auction price of $117 and market indices of approximately $190 in June.

AFFECTED POPULATION IN PHASE I

Exhibit 1 provides a summary of the affected population of units under the Acid Rain Program from 1995 through 1999. The table illustrates that although the units listed in Table 1 of the CAAA are consistently affected for both SO_2 and NO_x beginning in 1997, the total universe of affected units varies year to year because of the flexibility offered by the program.

Exhibit 1
Affected Units During Phase I of the Acid Rain Program

		1995	1996	1997	1998	1999
SO_2	Table 1	263	263	263	263	263
	Substitution and Compensating	182	161	153	Variable	Variable
	Opt-in	0	7	7	Variable	Variable
	TOTAL	***445***	***431***	***423***	***Variable***	***Variable***
NO_x	Table 1	NA	144	170	171	171
	Substitution	NA	95	95	95	95
	Early-Election	NA	NA	272	Variable	Variable
	TOTAL	***NA***	***239***	***537***	***Variable***	***Variable***

This report discusses the process and results of determining compliance for these Phase I affected units. Detailed appendices provide information on 1997 emissions and utilization for both SO_2 and NO_x affected sources, allowance holdings and deductions for SO_2 sources, and explanations of averaging plans and compliance flexibility and requirements for NO_x sources.

SO_2 PROGRAM

423 Units Underwent Annual Reconciliation for SO_2 in 1997

There were 416 affected utility units and seven opt-in units that underwent annual reconciliation in 1997 to determine whether sufficient allowances were held to cover emissions. These 423 units are listed in Appendix A and include 263 utility units specifically required to participate during Phase I, 153 utility units not initially required to participate until Phase II, but electing to participate early as part of multi-unit compliance plans, and seven other units that elected to join as part of the Opt-in Program.

The core 263 utility units, residing at 110 power plants, were selected by Congress in the 1990 Amendments to the Clean Air Act because they were the highest emitting and largest units. These units emitted 57 percent of all utility emissions in 1985, and had emission rates ranging from 2.5 to 10.2 lbs of SO_2/mmBtu of heat input, with an average of 4.2 lbs/mmBtu. These units are often referred to as "Table 1 units" because they are officially listed in Table 1 of the allowance allocation regulation, 40 CFR 73.10.

An additional 153 utility units affected in 1997 have been designated by certain Table 1 units to serve either as substitution or compensating units[2]. Appendix B-1 delineates the relation of these units to their Table 1 counterparts. In 1997, there were 152 substitution units and one compensating unit designated.

The seven opt-in units that entered the program in July 1996 remain in the program. The Opt-in Program gives sources not required to participate in the Acid Rain Program the opportunity to enter the program on a voluntary basis, install continuous emission monitoring systems (CEMS), reduce their SO_2 emissions, and receive their own allowances.

In 1997, there were 8 fewer units undergoing annual reconciliation than in 1996, and 22 fewer than in 1995. The change in number of units affected by the Phase I SO_2 provisions is due to the entry and exit of units in accordance with substitution and compensating plans of one or more of the original 263 Table 1 units and the entry of opt-in sources.

New Requirements for Phase I Extension Units in 1997

Under the Acid Rain Program, certain units applied for and received approval of Phase I Extension

[2]During Phase I of the of the Acid Rain Program, a unit not originally affected until Phase II may elect to enter the program early as a substitution unit or a compensating unit to help fulfill the compliance obligations for one of the Table 1 units targeted by Phase I. A unit brought into Phase I as a substitution unit can assist a Table 1 unit in meeting its emissions reductions obligations. Utilities may make cost-effective emissions reductions at the substitution unit instead of at the Table 1 unit, achieving the same overall emissions reductions that would have occurred without the participation of the substitution unit. A Table 1 unit may designate a Phase II unit as a substitution unit only if both units are under the control of the same owner or operator. Additionally, Table 1 units that reduce their utilization below their baseline may designate a compensating unit to provide compensating generation to account for the reduced utilization of the Table 1 unit. (A unit's baseline is defined as its heat input averaged over the years 1985-1987). A Table 1 unit may designate a Phase II unit as a compensating unit if the Phase II compensating unit is in the Table 1 unit's dispatch system or has a contractual agreement with the Table 1 unit, and the emissions rate of the compensating unit has not declined substantially since 1985.

plans during the Phase I permitting process. These units fell into two categories: "control units" which were required to cut their emission by 90 percent using qualifying technology[3] by 1997, and "transfer units" which reassigned their emissions reduction obligations to a control unit. Both kinds of units received extra SO_2 emissions allowances to cover the SO_2 they emitted beyond their basic Phase I allocations during 1995 and 1996. In addition, the control units were given Phase I extension allowances for 1997, 1998, and 1999. A total of 3.5 million allowances was distributed to all Phase I extension control and transfer units.

Beginning in 1997, each of the 19 units designated as control units was required to show it had reduced its annual emission by at least 90 percent using qualifying control technology. If a unit could not make this demonstration, all or a portion of the extension allowances it received for the year under the Phase I Extension provisions were required to be surrendered. In addition, also beginning in 1997, each of the same 19 control units and each of the 61 other units designated as transfer units was required to meet a tonnage emission limitation approved in its permit. A unit that exceeded its limitation was required to surrender allowances for the following year.

For 1997, all 19 control units demonstrated meeting the 90 percent reduction requirement and, therefore, did not surrender any 1997 extension allowances. The 1997 tonnage emissions limitation, though, was exceed by six control units and ten transfer units and resulted in a surrender of a total of 92,768 vintage 1998 allowances. The deduction amounts for each Phase I extension unit are included in Appendix B-2.

1997 SO_2 Emissions Target was 7.1 Million Tons

The number of allowances allocated in a particular year, the amount representing that year's allowable SO_2 emissions level, is the sum of allowance allocations granted to sources under several provisions of the Act. In 1997, the emissions target established by the program for the 423 participating units was 7.1 million tons. However, the total allowable SO_2 emission level in 1997 was actually 13.4 million tons, consisting of the 7.1 million 1997 allowances granted through the program and an additional 6.3 million allowances carried over, or banked, from 1996.

The initial allocation and the allowances for substitution and compensating units represent the basic allowances granted to units that authorize them to emit SO_2 under the Acid Rain Program. Additional allowances for the year 1997 were also made available through the allowance auctions, held annually since 1993. Other allowances issued in 1997 were from bonus provisions in the Act, which are briefly explained in Exhibit 2 on the following page. In addition, any allowances carried over from previous years (banked allowances) are available for compliance and included in the allowable total.

[3]Qualifying technology is defined in 40 CFR 72.2

Exhibit 2
Origin of 1997 Allowable Emissions Level

Type of Allowance Allocation	Number of Allowances	Explanation of Allowance Allocation Type
Initial Allocation	5,550,820	Initial Allocation is the number of allowances granted to units based on their historic utilization, emissions rates specified in the Clean Air Act and other provisions of the Act.
Phase I Extension	271,334	Phase I Extension allowances are given to Phase I units that reduce their emissions by 90 percent or reassign their emissions reduction obligations to units that reduce their emissions by 90 percent.
Allowances for Substitution Units	1,024,178	Allowances for Substitution Units are the initial allocation granted to Phase II units which entered Phase I as substitution units.
Allowance Auctions	150,000	Allowance Auctions provide allowances to the market that were set aside in a Special Allowance Reserve when the initial allowance allocation was made.
Allowances for Compensating Units	15,838	Allowances for Compensating Units are the initial allocation granted to Phase II units which entered Phase I as compensating units.
Opt-in Allowances	95,882	Opt-in Allowances are provided to units entering the program voluntarily.
Small Diesel Allowances	27,578	Small Diesel Allowances are allocated annually to small diesel refineries that produce and desulfurize diesel fuel during the previous year. These allowances can be earned through 1999.
Conservation Allowances	11,834	Conservation Allowances are awarded to utilities that undertake efficiency and renewable energy measures prior to their first compliance year. The allowances come from a special Conservation and Renewable Energy Reserve set aside when the initial allowance allocation was made.
TOTAL 1997 ALLOCATION	**7,147,464**	
BANKED 1996 ALLOWANCES	6,288,335	Banked Allowances are those held over from 1995 and 1996 which can be used for compliance in 1997 or any future year.
TOTAL 1997 ALLOWABLE	**13,435,799**	

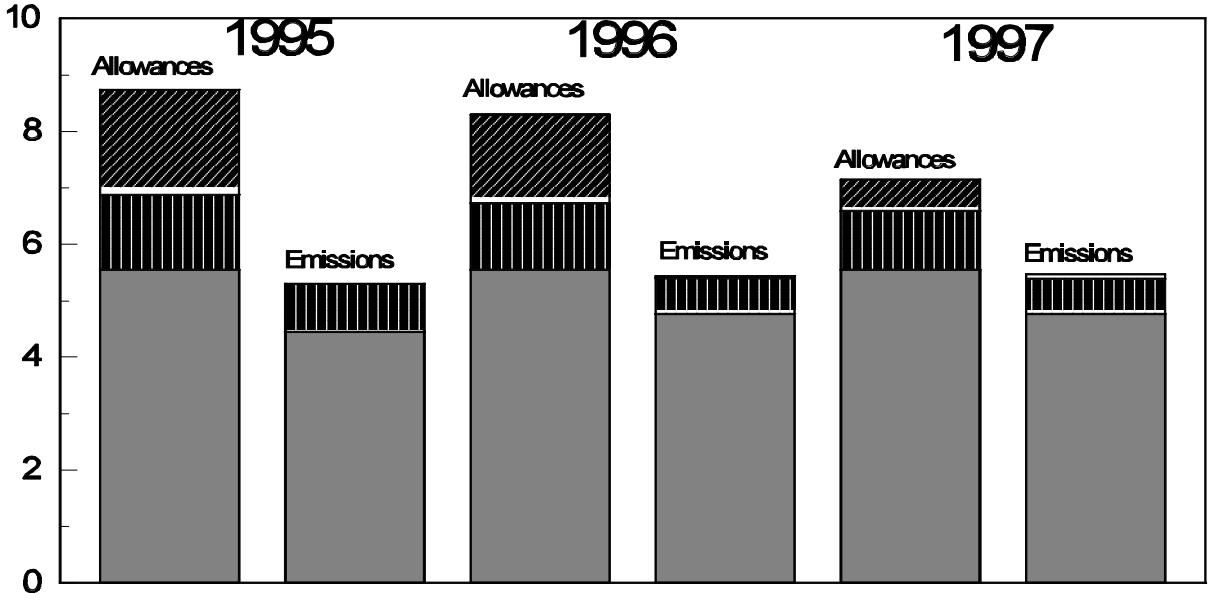
Beginning in the year 2000 at the onset of Phase II, the volume of allowances allocated annually to the Phase I units will be reduced and the requirement to hold allowances will be extended to smaller, cleaner plants. Nationwide, the cap for all utilities with an output capacity of greater than 25 megawatts will be 9.48 million allowances from 2000-2009. In 2010, the cap will be reduced further to 8.95 million allowances, a level approximating one half of industry-wide emissions in 1980.

SO_2 COMPLIANCE RESULTS

Phase I Units Better 1997 SO_2 Allowable Emissions Level by 23 Percent

The Phase I units affected in 1997 emitted at a level approximately 23 percent below 1997 allocations, as shown in Exhibit 3. Although this percentage is significantly lower than in 1996, it is not due to an increase in emissions but rather due to a decrease in allocations, primarily due to the much lower number of Phase I extension allowances allocated for 1997. The Phase I units emitted 5.5 million tons of SO_2, expending only about 41 percent of the 13.4 million allowances available in 1997. Appendix B-3 reports the 1997 emission and utilization levels for all Phase I affected units, as well as a comparison to these levels in 1996 and 1995.

Exhibit 3
Summary of SO_2 Emissions versus Allocations
(Millions of Tons)



	'95 Allocation	'95 Emissions	'96 Allocation	'96 Emissions	'97 Allowances	'97 Emissions
Table 1 Units	5.55	4.45	5.55	4.77	5.55	4.77
S & C Units*	1.33	0.85	1.18	0.63	1.04	0.62
Other**	1.86	0.00	1.57	0.04	0.56	0.08
TOTALS	8.74	5.30	8.30	5.44	7.15	5.47

* There were 182 substitution and compensating units in 1995 and 161 and 153 such units in 1996 and 1997, respectively.

** The source of the "other" emissions in 1996 and 1997 is the 7 opt-in units. The "other" allocations in all years consist of Phase I Extension, opt-in, small diesel, conservation and annual auction allowances.

Relative to 1996, the 263 Table 1 units increased their emissions by less than 10,000 tons, or less than one percent in 1997, while increasing their utilization by three percent. The 4.8 million tons emitted by these Table 1 units were still substantially below their 1997 allocation of 5.6 million allowable tons.

Just over half of the Table 1 units (52 percent) increased their emissions relative to 1996 by an average of 3,400 tons. Most of the remaining Table 1 units (44 percent) decreased their emissions from 1996 levels by an average of 3,900 tons. The remaining eight Table 1 units maintained the same zero emission level of 1996.

In terms of utilization, almost half (46 percent) of Table 1 units decreased their levels by an average of 10 percent, while just over half (51 percent) increased their utilization since 1996 by an average of 27 percent.

Substitution and compensating units in 1997 expended a larger percentage of their annual allocation than in 1996. In 1997, these 153 units were responsible for emitting approximately 621,000 tons of SO_2, about 60 percent of their 1.04 million allocation. In 1996, 161 substitution and compensating units emitted approximately 610,000 tons of SO_2, or slightly more than half of their allowable level.

Of the 153 units in 1997, 44 percent increased their emissions relative to 1996 by an average of 1,500 tons, while 30 percent of the units decreased their emissions by an average of 900 tons. The remainder of the units maintained their status as zero emitters.

Forty two percent of substitution and compensating units increased their utilization between 1996 and 1997, while 34 percent of units experienced a decrease in utilization. The remaining 24 percent of substitution and compensating units were not utilized again in 1997.

Opt-in units received 95,882 allowances in 1997 as a reflection of their baseline emissions levels, but contributed only 77,037 tons to 1997 emission levels. Although this is an increase of approximately 40,000 tons over 1996, the 1997 data represent operations for the entire calendar year of 1997, whereas in 1996, the opt-in units were only affected for the second half of the year.

Deducting Allowances for Compliance

The total number of allowances deducted in 1997 was 5,480,210 which represents approximately 77 percent of all 1997 allowances issued. Almost all (99.9 percent) of the deducted allowances were for emissions. Exhibit 4 on the following page displays these allowance deductions, as well as the remaining bank of 1995, 1996, and 1997 allowances.

At an individual unit, the number of allowances surrendered was equal to the number of tons emitted at the unit, except where the unit shared a common stack with other units. For the purposes of surrendering allowances for emissions at a common stack, the utility was allowed to choose the proportion of allowances deducted from each unit sharing the stack, as long as enough allowances were surrendered to cover the total number of tons emitted. If no apportionment was made, EPA deducted allowances equally among the units sharing the stack to cover total emissions reported by the stack. Appendix B-3 reflects the deductions for emissions at each unit after the common stack apportionment was made. Units sharing a common stack are listed directly under the entry for their common stack.

In 1997, Phase I units had a total of 5,474,440 allowances deducted for emissions. Of the 423 units, Paradise Unit 3 in Kentucky for the third year in a row surrendered the most allowances for emissions (173,285), an increase of 18 percent over 1996. Fifty units were not operated at all during the year and

surrendered no allowances. Half of the units surrendered under 7,000 allowances, while the average number of allowances deducted at a unit was 12,944.

The remaining 0.1 percent (5,770) of allowance deductions were made for underutilization and control-by-contract, which are explained in detail in Appendix B-4.

Exhibit 4
SO_2 Allowance Reconciliation Summary

Total Allowances Held in Accounts as of 1/30/98 (1995, 1996, & 1997 Vintages)*	**13,435,799**
Table 1 Unit Accounts	7,942,551
Substitution & Compensating Unit Accounts	1,288,988
Opt-in Accounts	85,126
Other Accounts**	4,119,134
1997 Allowances Deducted for Emissions	**5,474,440**
Table 1 Unit Accounts	4,774,609
Substitution & Compensating Unit Accounts	620,794
Opt-in Unit Accounts	79,037
1997 Allowances Deducted Under Special Phase I Provisions***	**5,770**
Table 1 Unit Accounts	1,733
Substitution & Compensating Unit Accounts	2,949
Opt-in Unit Accounts	1,309
Banked Allowances	**7,955,368**
Table 1 Unit Accounts	3,166,209
Substitution & Compensating Unit Accounts	665,245
Opt-in Unit Accounts	4,780
Other Accounts**	4,119,134

* The number of allowances held in the Allowance Tracking System (ATS) accounts equals the number of 1997 allowances allocated (see Exhibit 2) plus the number of 1996 banked allowances. January 30, 1998 represents the Allowance Transfer Deadline, the point in time at which the 1997 Phase I affected unit accounts are frozen and after which no transfers of 1995,1996, and 1997 allowances will be recorded. The freeze on these accounts is removed when annual reconciliation is complete.

** Other accounts refers to general accounts within the ATS that can be held by any utility, individual or other organization, and unit accounts for units not affected in Phase I.

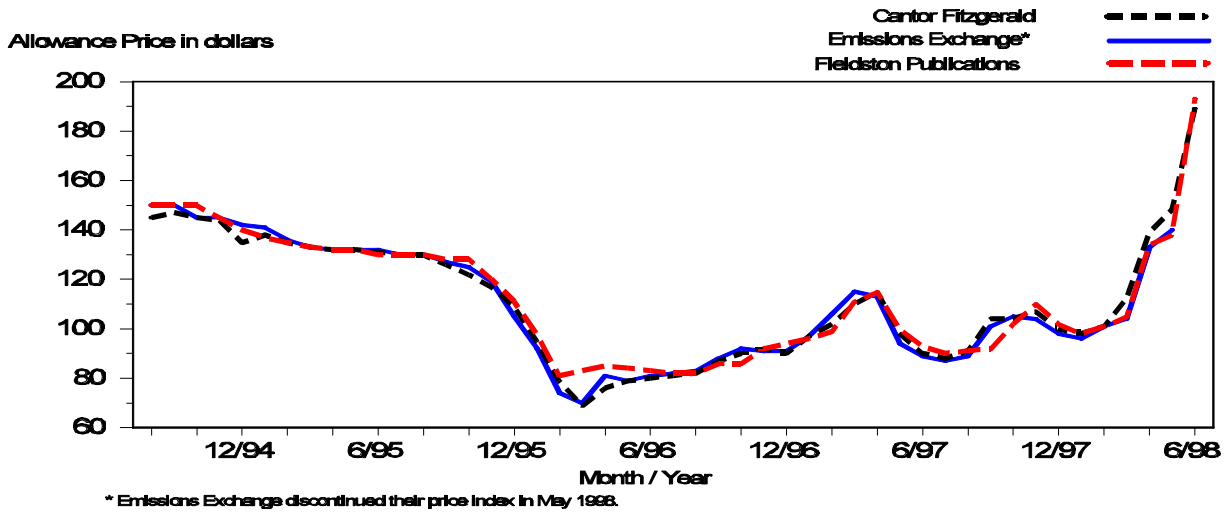
***Allowances were deducted for both underutilization and control-by-contract provisions in 1997 (see Appendix B-4 for a thorough explanation).

SO_2 ALLOWANCE MARKET

The flexibility provided by the Acid Rain Program enabled the 423 units affected in 1997 to pursue a variety of compliance options to meet their SO_2 reduction obligations, including scrubber installation, fuel switching, energy efficiency, and allowance trading. The presence of the allowance market has given some sources the incentive to overcontrol their SO_2 emissions in order to bank their allowances for use in future years. Other sources have been able to postpone and possibly avoid expenditures for control by acquiring allowances from sources that overcontrolled. The flexibility in compliance options is possible because of the accountability provided through strict monitoring requirements for all affected units that ensure one allowance is equivalent to one ton of SO_2. The program's flexibility enabled all 423 sources to be in compliance in 1997 and significantly reduced the cost of achieving these emissions reductions as compared to the cost of a technological mandate.

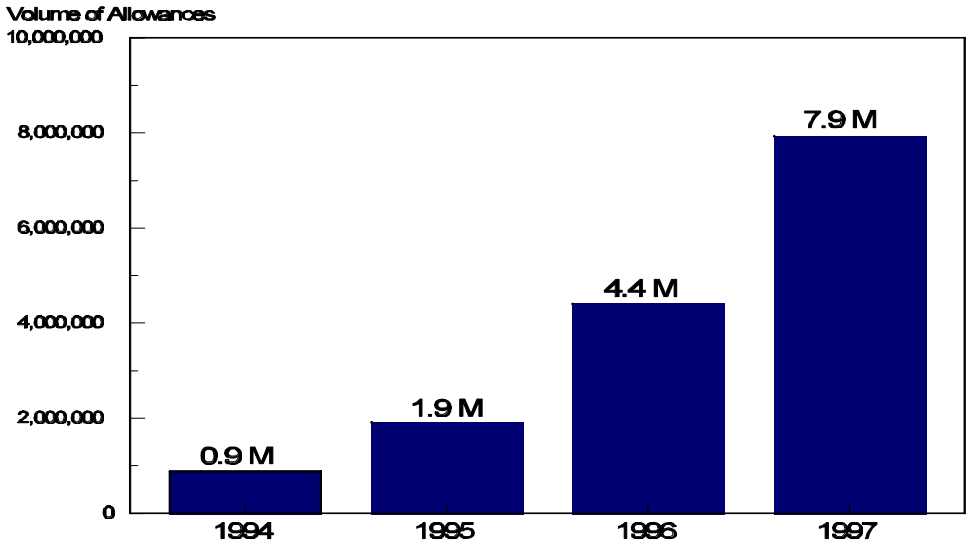
The marginal cost of reducing a ton of SO_2 from the utility sector should be reflected in the price of an allowance. The cost of reductions continues to be lower than anticipated when the Clean Air Act Amendments were enacted, and the price of allowances reflects this. The cost of compliance was initially estimated at $400-1000/ton, but dropped to a low of just $68/ton at the 1996 allowance auction. Following this low, however, the price of a current vintage year allowance climbed to $110 in the 1997 auction, after which time it dipped once again into the $88 range, only to finish 1997 at about $100. Prices have increased during the first half of 1998, with a March 1998 auction price of $117 and market indices of approximately $190/ton in June, 1998. Some market observers believe lower than expected allowance prices during the first several years of the program were due primarily to lower than expected compliance costs and larger than expected emission reductions, which have increased the supply of allowances and put downward pressure on prices. Exhibit 5 displays the price trend since mid-1994, based on monthly price reports from two brokerage firms, Emissions Exchange Corporation and Cantor Fitzgerald Environmental Brokerage Services, and a market survey conducted by Fieldston Publications.

Exhibit 5



Activity in the allowance market created under the Acid Rain Program continued to grow in 1997, with 1,429 transactions moving over 15 million allowances reported to the Allowance Tracking System (ATS), the accounting system developed to track holdings of allowances. In terms of economically significant transfers, or those between unrelated parties, the volume of allowances transferred rose from 1.9 million in 1995 to 4.4 million in 1996 and to 7.9 million in 1997, as shown in Exhibit 6. The total for 1997 exceeds the total of the three previous years combined. Growth is also evident in the subset of economically significant transfers representing only those allowances acquired by utilities (rather than all those exchanged by unrelated parties through the market); volume has increased from 700,000 allowances in 1995 to 1.6 million in 1996 and to 2.8 million in 1997. In addition, more than 80 percent of the accounts established for affected units under the program have been involved in at least one private transfer registered in ATS. Almost half of allowances with vintage years 1995 and 1996 have been involved in at least one transfer as well. To date, approximately 35 percent of 1997 allowances have been involved in a transfer under the Acid Rain Program.

Exhibit 6
Volume of SO_2 Allowances in Economically Significant Transfers



EPA seeks to minimize transaction costs to parties trading allowances in the market by quickly and efficiently recording transfers reported to the Agency in ATS. In 1997, EPA processed 89 percent of allowance transactions within 24 hours of receipt, up slightly from the 1996 rate of 83 percent. Ninety-eight percent were processed within 5 days. These transactions, along with data on account balances and ownership, are posted on the Acid Rain Division's Internet site (www.epa.gov/acidrain) on a daily basis in order to better inform trading participants. Also available are cumulative market statistics and analysis.

NO_X PROGRAM

Instead of using allowance trading to facilitate emissions reductions, the Title IV NO_x program establishes standard emission limitations for affected units. Title IV of the 1990 Clean Air Act Amendments required EPA to establish NO_x annual average emission limits (in pounds of NO_x per million British thermal units of fuel consumed (lb/mmBtu)) for coal-fired electric utility units in two phases.

In April 1995, EPA promulgated 40 CFR Part 76 which established NO_x emission limits beginning on January 1, 1996 for Group 1 boilers that were also part of the Phase I SO_2 program. (Group 1 boilers are dry bottom, wall-fired boilers and tangentially fired boilers.) Phase I dry bottom wall-fired boilers are subject to a NO_x emission limit of 0.50 lb/mmBtu; Phase I tangentially fired boilers are subject to a NO_x emission limit of 0.45 lb/mmBtu.

In addition, the April 1995 regulations allowed Phase II Group 1 units to use an "Early Election" Compliance Option. Under this regulatory provision, Group 1, Phase II NOx affected units can demonstrate compliance with the higher Phase I limits for their boiler type from 1997 through 2007 and not meet the more stringent Phase II limits until 2008. If the utility fails to meet this annual limit for the boiler during any year, the unit is subject to the more stringent Phase II limit for Group 1 boilers beginning in 2000, or the year following the exceedance, whichever is later.

In December 1996, EPA revised the NO_x emission limits for Phase II, Group 1 boilers (0.46 lb/mmBtu for dry bottom wall-fired boilers and 0.40 lb/mmBtu for tangentially fired boilers) and established emission limits for cell burner, cyclones, wet bottom and vertically-fired boilers (referred to as "Group 2 boilers") effective on January 1, 2000. As a result of the April 1995 and December 1996 rulemakings, NO_x reductions were projected to be approximately 400,000 tons per year in 1996 through 1999 (Phase I), and 2,060,000 tons per year in 2000 and subsequent years (Phase II).

PHASE I NO_X UNITS

265 Phase I Units Were Subject to Emission Limitations in 1997

In 1997, 265 coal-fired utility units were subject to the Title IV Phase I emission limitations for NO_x, an increase of 26 units from 1996. The 265 Phase I NO_x affected units include 170 Table 1 units and 95 substitution units whose owners chose to participate in Phase I as part of an SO_2 compliance strategy. This group of units (along with one additional unit whose compliance extension expired at the end of 1997) will be subject to the Phase I emission limitations throughout Phase I and Phase II. Exhibit 7 shows the number of Phase I NO_x affected units by boiler type.

Exhibit 7
Phase I NO_x Units by Boiler Type

Boiler Type	Standard Emission Limit	Table 1 Units	Substitution Units	All Units
Tangentially fired Boilers	0.45	93	42	135
Dry Bottom Wall-fired Boilers	0.50	77	53	130

Phase I NO_x Compliance Options

For each Phase I NO_x affected unit, a utility can comply with the applicable standard emission limitation, or may qualify for one of three additional compliance options which add flexibility to the rate-based compliance requirements:

- **Emissions Averaging**. A utility can meet the standard emission limitation by averaging the heat-input weighted annual emission rates of two or more units.

- **Alternative Emission Limitation (AEL)**. A utility can petition for a less stringent alternative emission limitation if it uses properly installed and operated low NO_x burner technology (LNBT) designed to meet the standard limit, but is unable to achieve that limit. EPA determines whether an AEL is warranted based on analyses of emissions data and information about the NO_x control equipment.

- **Phase I NO_x Extensions**. Twenty-seven Group 1 boilers affected in Phase I qualified for a Phase I NO_x extension for 1996. All of the extensions expired on December 31, 1996, except for one that expired on July 31, 1997, and another that expired on December 31, 1997.

Exhibit 8 summarizes the compliance options chosen by Phase I affected NO_x units for 1997. As in 1996, averaging was the most widely chosen compliance option. For 1997, utilities submitted 24 averaging plans involving 204 Phase I NO_x units. For seven plans involving 22 units, the averaging plan was not necessary to balance compliance among units; all units within the plan met their applicable emission limit individually. See Appendix C-1: List of Averaging Plans and Results in 1997.

Exhibit 8
Compliance Options Chosen in 1997

Compliance Option	Number of Units
Compliance with Standard Emission Limitation	52
Emissions Averaging	204
Alternative Emission Limitation	7
SUBTOTAL	263
Pending Alternative Emission Limitation Petition	1
Pending Alternative Emission Limitation Petition for Partial Year Compliance	1
Part 76 Phase I NO_x Extension	1
TOTAL	266

PHASE I NO_X COMPLIANCE RESULTS

EPA has determined that 263 out of the 265 Phase I NO_x units met the required emission limit through compliance with either the standard emission limitation, emissions averaging, or an alternative emission limitation[4]. The two other Phase I units are conditionally in compliance pending a decision on their alternative emission limitation petitions which was pending as of July 1998. The 266th unit will become a Phase I affected unit in 1998. See Appendix C-2: Compliance Results for the 266 NO_x Affected Units. For a more detailed description of EPA's methodology for determining compliance with Phase I NO_x limits, see Appendix C-4 in the Acid Rain Program 1996 Compliance Report.

NO_x Emission Rate Reduction

Many units emitted at rates well below the emission limits, as shown in Exhibit 9. Utilities operated the affected group of Phase I NO_x boilers at NO_x emission rates approximately 16 percent below the allowable rate in 1997, compared to 18 percent below in 1996.

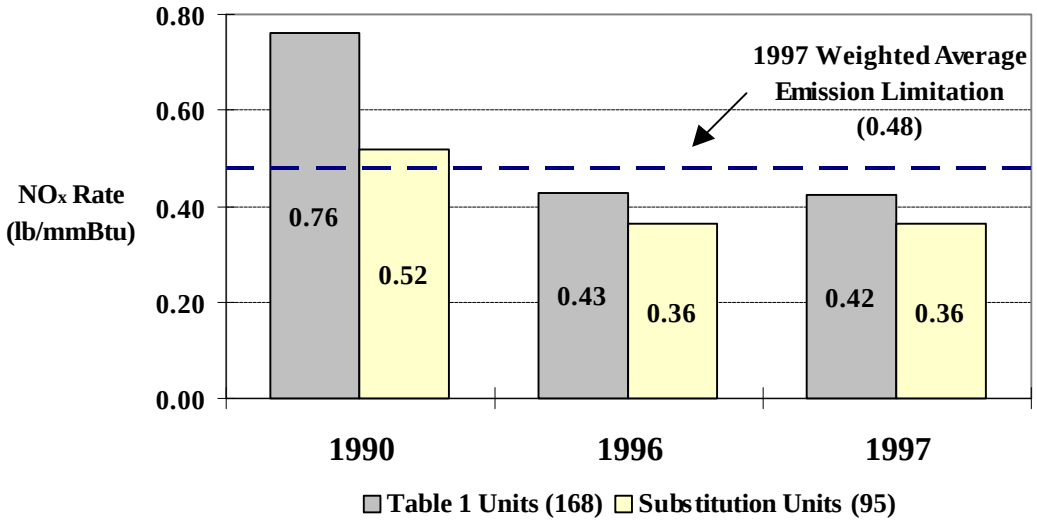
[4] The analyses in this section focus on these 263 units.

Exhibit 9
Percentage Compliance Relative to Allowable Emission Rate in 1997

Percent Below Applicable Limit	Units Subject to Standard Limit	Units Using Averaging	Units Subject to AEL Demonstration	Total
0 - 10%	20	99	4	123
10% - 25%	15	87	2	104
More than 25%	17	18	1	36
Total	52	204	7	263

From 1990[5] to 1997, the average NO_x emission rate of the 263 Phase I units declined by 42 percent (from 0.69 lb/mmBtu to 0.40 lb/mmBtu). As shown in Exhibit 10, on average, both Table 1 and substitution units were below the average Phase I emission limit of 0.48 lb/mmBtu (the 1997 heat input weighted average of the applicable limits).

Exhibit 10
Average NO_x Emission Rates for 263 Phase 1 Units



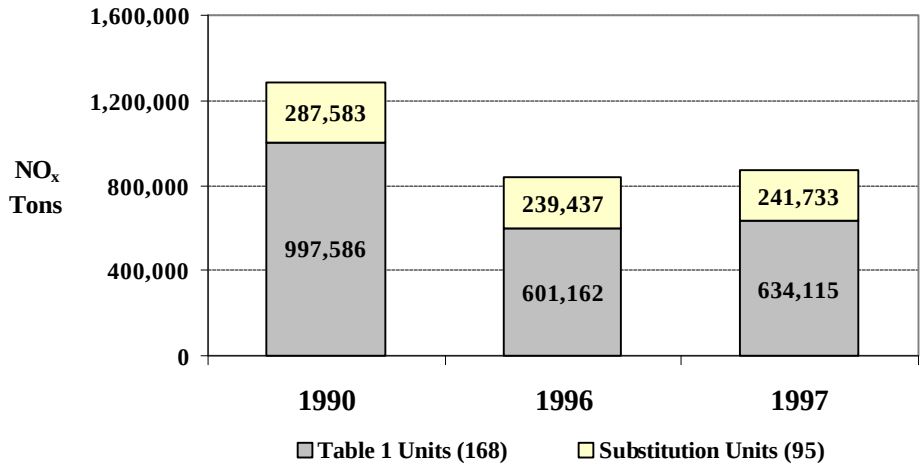
NO_x Mass Emissions Reduction

Total NO_x mass emissions also declined from 1990 to 1997, but not as significantly as the NO_x emission rate. Exhibit 11 illustrates the change in NO_x mass emissions from 1990 to 1997 for Table 1 and substitution units. The Table 1 units exhibited a 36 percent reduction in NO_x tons, and the substitution units showed a 16 percent reduction. For the 263 Phase I units, annual NO_x emissions reductions

[5] For a more detailed description of the 1990 baseline refer to the Acid Rain Program 1996 Compliance Report.

between 1990 and 1997 totaled approximately 409,322 tons, or a 32 percent reduction. However, NO_x mass emissions in 1997 increased slightly from 1996, attributable to greater electrical production, as evidenced by a five percent increase in heat input. Without further reductions in emissions rates, NO_x emissions would be expected to rise with increased utilization. As in 1996, the lower percentage of reductions for substitution units is probably attributable to the fact that many of these units were already lower emitters subject to New Source Performance Standards (NSPS).

Exhibit 11
NO_x Mass Emissions for 263 Phase I Units



PHASE II EARLY ELECTION UNITS

272 Units Were Subject to Early Election Requirements in 1997

Nineteen ninety-seven was the first year in which utilities could choose to use the "Early Election" compliance option provided in Part 76. Owners and operators of 272 units applied for this option. Exhibit12 shows the number of Early Election units by boiler type.

Exhibit 12
Distribution of 1997 Early Election Units by Boiler Type

Boiler Type	Standard Emission Limit	Operating Group 1, Phase 2 Units	Early Election Units	Percent of Units Electing
Tangentially fired	0.45	300	170	56.7%
Dry Bottom Wall-fired	0.50	314	102	32.5%
Total		614	272	44.3%

PHASE II EARLY ELECTION COMPLIANCE RESULTS

For 1997, EPA determined that 270 units complied with the Phase I, Group 1 emission limitations and have continued eligibility for Early Election in 1998 through 2007. An additional two units subject to Early Election complied with the Phase I, Group 1 emission limit, however, their compliance is pending, while their permit is being reviewed. See Appendix C-3: Compliance Results for the 272 Early Election Units in 1997.

NO_x Emission Rate Reduction

In 1997, many Early Election units emitted at rates well below the applicable emission limit, as shown in Exhibit 13. Utilities operated dry-bottom wall-fired boilers at NO_x emission levels approximately 23 percent below the limit of 0.50 lb/mmBtu and tangentially fired boilers approximately 18 percent below the limit of 0.45 lb/mmBtu.

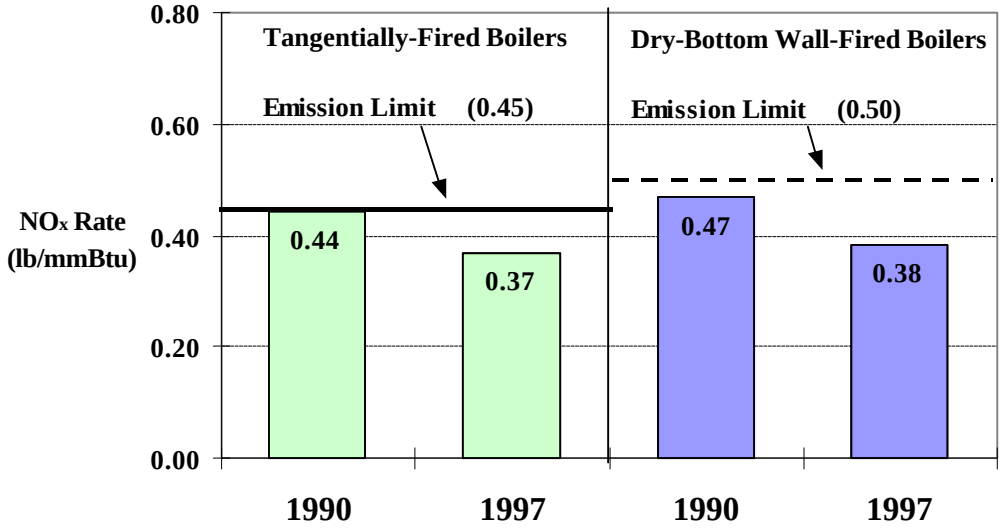
Exhibit 13
Percentage Compliance Relative to Emission Limits

Percent Below Applicable Emission Limitation	Early Election Units
0 - 10%	94
10 - 25%	112
More than 25%	66
Total	272

Average NO_x emission rates for Early Election units have declined by 17 percent, from 0.46 lb/mmBtu in 1990 to 0.38 lb/mmBtu in 1997. This decline is less dramatic than the decline at Phase I NO_x units because 51 percent of the Early Election units are newer units already subject to the NSPS NO_x emission limits. The overall NO_x emission rate for these units is comparable to the average rate of 0.40 lb/mmBtu for all Phase I NO_x units.

Exhibit 14 summarizes the NO_x emission rate reductions from 1990 to 1997 by boiler type for the 262 Early Election units which were operating in 1990.

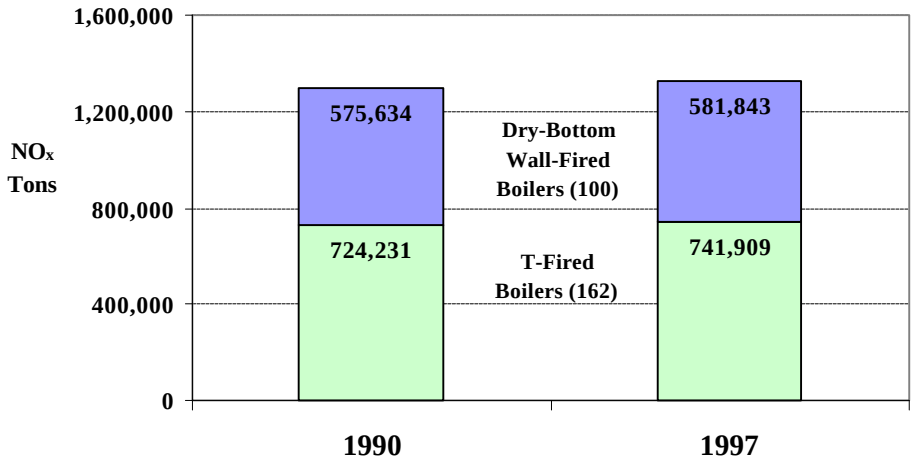
Exhibit 14
Average NO_x Emission Rate for 262 Early Election Units



NO_x Mass Emissions Reduction

The total NO_x mass emissions from the operating Early Election units increased by 23,887 tons (or 2 percent) from 1990 to 1997, reflecting an increase in utilization (see Exhibit 15). For the 262 Early Election units operating in 1990, heat input increased during the seven year period by approximately 24 percent.

Exhibit 15
NO_x Mass Emissions for 262 Early Election Units



SO_2 AND NO_x MONITORING IN 1997

In order to verify the reductions of SO_2 and NO_x emissions mandated under the Clean Air Act and to support the SO_2 allowance trading program, a fundamental objective of the Acid Rain Program is to ensure accurate accounting of pollutant emissions from affected boilers and turbines. To implement this objective, concentrations of emitted SO_2 and NO_x from each affected unit (boiler or turbine) are measured and recorded using Continuous Emissions Monitoring Systems (CEMS) (or an approved alternate measurement method) certified by EPA to meet the high accuracy standards of the Acid Rain Program.

CEMS are used to determine SO_2 mass emissions and NO_x emission rates. SO_2 mass emissions are determined using CEMS to measure SO_2 concentration and stack flow rate. NO_x emission rates, on the other hand, are determined with NO_x and diluent gas (CO_2 or O_2) concentration monitors. These monitors are required to meet strict initial and on-going performance standards to demonstrate the accuracy, precision, and timeliness of their measurement capability.

One measure of the accuracy of a CEMS is the relative accuracy test audit (RATA), which is required for initial certification of a CEMS and for on-going quality assurance. The relative accuracy test audit ensures that the installed monitor measures the "true" value of the pollutant by comparing the monitor to a reference method which simultaneously measures the stack gas pollutant. Thus, the lower the relative accuracy resulting from the test audit, the more accurate the monitor. All monitoring systems must meet a certain relative accuracy standard in order to be qualified to report emissions to the Acid Rain Program; 10 percent for SO_2 and NO_x, and 15 percent for flow (beginning January 1, 2000, the flow standard will also be 10 percent). As a further incentive for high quality maintenance, CEMS that achieve a superior accuracy result**,** less than or equal to 7.5 percent for SO_2 and NO_x and less than or equal to 10 percent for flow (beginning January 1, 2000, the flow standard for superior accuracy will also be 7.5 percent), are granted a reduced frequency annual RATA requirement in place of the semiannual requirement. Because the RATA determines relative accuracy as an absolute value, it does not detect whether the difference between the reference method values and the readings from the CEMS being tested is due to random error or to systematic bias. Therefore, an additional test is required to ensure that emissions are not underestimated: the bias test. This test determines if the CEMS is systematically biased low compared to the reference method and if so, a bias adjustment factor is calculated and applied to all reported data from that monitoring system to ensure there is no systematic underreporting. Exhibit 16 highlights the relative accuracy results achieved by Acid Rain CEMS in 1997.

Exhibit 16
1997 Relative Accuracy Test Audit (RATA) Results

	SO_2 Concentration	**Volumetric Flow Rate**	**NO_x Rate**
Mean Relative Accuracy	3.9%	4.2%	4.0%
Median Relative Accuracy	3.2%	3.5%	3.3%
Percent Meeting Relative Accuracy Standard	97%	99%	97%

Another metric used to determine the effectiveness of a CEMS is the percentage of hours that a

monitoring system is operating properly and meeting all performance standards and therefore, able to record and report an emissions value. This metric is defined as the percent monitor availability (PMA). Exhibit 17 shows the monitor availabilities reported in 1997 and indicates that the CEMS used to determine SO_2 mass emissions and NO_x emission rates are well maintained and fulfilling the high performance standards required by the Acid Rain Program.

Exhibit 17
1997 CEMS Availability

Parameter	Median % Availability at End of 1997	
	Coal-Fired Units	Oil and Gas Units
SO_2	99.3	98.3
Flow	99.6	98.7
NO_x	99.1	97.7

CONCLUSION

Both the Acid Rain Program's rate-based approach to NO_x reduction and cap-and-trade approach to SO_2 reduction have been very successful. In 1997, all 502 Phase I affected utility units not only met their compliance goals, but exceeded them, achieving an overall reduction of 409,322 tons of NO_x from 1990 levels despite an increase in generation, and maintaining the extraordinary reductions of more than 5 million tons of SO_2 from 1980 levels, first achieved in 1995. Additionally, the 272 Phase II units newly affected for NO_x in 1997 under the early election program had increased emissions of only two percent since 1990, while their utilization increased by 24 percent during the same period.

Exceedance of compliance goals translates into additional environmental and health benefits. For example, the greater and earlier reductions of SO_2 have resulted in a 10 - 25 percent drop in rainfall acidity in the Northeast in 1995[6].

One factor mitigating the benefit of the overcompliance in the SO_2 program, of course, is the ability to use banked allowances in the future. The 40 percent of 1995 allowances, 35 percent of 1996 allowances, and 23 percent of 1997 allowances that were not retired for compliance purposes can be used to cover emissions in a later year. However, immediate health and environmental benefits are arguably more valuable than a benefit several years from now.

The NO_x program, based on the more traditional rate-based approach, offers less flexibility and displays a lesser degree of overcompliance. It requires each unit to achieve reductions or, at a minimum, for a group of units to achieve an average emission rate equal to or lower than their individual limits. This approach does not allow emission reductions in one year to be used in another year, and as a result, the incentive to overcomply is diminished.

The pattern and certainty of emissions reductions over time will also differ between the two programs. After the year 2000 when both programs are in full implementation, SO_2 emissions are expected to decline steadily to the emissions cap level of 8.95 million tons, whereas NO_x emissions, in the absence of an emissions cap, are expected to rise as existing sources are utilized more and new sources, which are not required to offset their emissions, are built and operated.

Despite these differences, both the SO_2 and NO_x components of the Acid Rain Program have been very successful in 1997. The significant progress evident at this stage of the program is encouraging. Through the continued efforts of Phase I participants and by additional reductions from Phase II units beginning in 2000, the long term goals of the Acid Rain Program -- a 10 million ton reduction of SO_2 emissions and two million ton reduction of NO_x emissions -- will be achieved.

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[6] U.S. Geological Survey, Trends in Precipitation Chemistry in the United States, 1983-94 - An Analysis of the Effects in 1995 of Phase I of the CAAA of 1990, Title IV, USGS 96-0346, Washington, DC, June 1996.